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WG-5407.

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ABSTRACT

The standard is used to grade nonsupervisory jobs involved in controlling the generation or distribution of electric power. The jobs are located at power generating plants, power distribution centers, and substations. The work requires ability to anticipate load changes due to work schedules, weather, and other variables, in order to engage or cut out power sources; to interpret wiring diagrams for a complete primary power system in order to plan routings and locate failures; and to determine the need for and follow emergency procedures in order to insure safety and provide continuous electric service. Employees must know how to operate electric power generating and controlling equipment. Two grade levels of electric power controller, WG-8 and WG-10, are differentiated in the description of job duties, skill and knowledge requirements, area of responsibility, physical effort needed, and the working conditions. Two typical work situations are described for the WG-10 level. (Author/AG)

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WORK COVERED

This standard is used to grade nonsupervisory jobs involved in controlling the generation or distribution of electric power. The jobs are located at power generating plants, power distribution centers, and substations. This work requires ability to anticipate load changes due to work schedules, weather, etc., in order to engage or cut out power sources; to interpret wiring diagrams for a complete primary power system in order to plan routings and locate failures; and to determine need for and follow emergency procedures in order to insure safety and provide continuous electric service. Employees must know how to operate electric power generating and controlling equipment, such as high voltage generators, rotary converters, transformers, motor-generators, and remotely operated switches and circuit breakers.

WORK NOT COVERED

Not covered by this standard is work primarily involving:

- Installing, testing, repairing and maintaining generators, transformers, converters, and associated equipment in a powerhouse or power substation, or installing, repairing and maintaining primary overhead and underground electrical distribution systems (Electrician (High Voltage), WG-2810).
- Operating boiler plants to generate steam for electrical power (Boiler Plant Operator, WG-5402).

TITLES

Jobs graded by this standard are to be titled *Electric Power Controller*.

GRADE LEVELS

This standard describes two grade levels, WG-8 and WG-10. Two typical work situations are described for the WG-10 level. The standard does not describe all possible grade levels for this occupation. If jobs differ substantially from the skill, knowledge and other work requirements described for the jobs in the standard, they may be graded

at levels other than those described, based on the application of sound job grading methods.

Special Additional Responsibilities: This section provides guidance for determining the grade level of certain plant operating situations. The Electric Power Controller standard describes the normal operation. However, employees in certain electric power controlling operations work under special circumstances. When positions fall within the circumstances described below, one additional grade may be added to controller positions whether they work alone or with a small group of employees.

Most electric power control rooms run on a 7-day, 3-shift plan and the controllers alternate working hours on all three shifts and on weekends as well as weekdays. On the night shifts and on weekends, one controller is usually *in charge* of the complete control room and is responsible for following instructions which are supplied to him in writing from a supervisor or which are relayed to him by the previous shift operator. The night controller or the weekend controller is, therefore, required to perform additional duties which are more responsible and which require more skill and knowledge than that of the regular day shift controller where a supervisor is available to provide guidance and assistance.

For example, in the event of a breakdown or a malfunction of equipment, the night or weekend controller must determine the cause and the seriousness and decide whether to shut down the operation or attempt to bypass the trouble until maintenance can be performed or until a supervisor can be located and notified. He may decide to shed a portion of the load or he may make minor repairs. He must be thoroughly familiar with the entire system in order to decide what work must be done, how high a priority the work has, and whether additional workers should be called in. He authorizes the work and any overtime needed. He has the responsibility for relaying instructions to the next shift controller including problems encountered and action taken.

While these and other similar situations do not describe supervisory responsibilities, they represent a situation which indicates that the shift controller uses more skill and knowledge than other controllers and he operates the control room with more responsibility than controllers who have a supervisor who is available for technical advice and guidance.

JOB GRADING SYSTEM

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WG-5407

Additional credit will be added only to electric power controllers who are assigned shift responsibility on a regular and recurring basis. Credit will not be given controllers who regularly work only when a supervisor is present on the same shift.

WG-5407-8

Electric Power Controller, WG-8

WG-5407-8

Duties: The Electric Power Controller, WG-8, distributes and controls electrical energy through a primary electrical distribution system connecting a moderate number of transformer and switching stations presenting limited routing possibilities. The power system serves office or residential users. The system is characterized by stable load demands and predictable degree and timing of variations. The electric power controller may be located at a central control switchboard of a moderate-sized activity or a manually controlled substation of a larger system such as at a military base or similar self-contained distribution system.

The Electric Power Controller, WG-8, monitors the distribution of electric power to various consumer points. He operates switchboard controls to adjust remotely controlled circuit breakers, transformers, and switches to regulate and maintain proper voltage on the distribution lines; reports abnormal operating conditions; and reroutes power through alternate feeders to user areas in case of emergency cutouts or extensive scheduled repair. He notifies repair crews of location of failure and assures that circuits are open and tagged before work is started.

In addition, the controller may operate switchboard controls to start, stop, cut in and out, and synchronize diesel-electric generators to provide emergency power or meet peak power demands. He keeps an hourly log of meter readings and records shutdowns, connecting and disconnecting of circuits, and similar occurrences.

Skill and knowledge: Ability to operate a control board and associated switches and circuit breakers of a system characterized by stable load demands and predictable load variations such as office or residential loads which are primarily resistive in nature. Ability to detect improper line voltage, open circuits or similar conditions from meter readings in the control room and adjust controls, such as changing transformer taps, or direct work crews to switch feeders in or out.

Knowledge of fundamental AC circuit theory, e.g., how generators and transformers function, and the inductive and capacitive reactance of power distribution lines, in order to understand the effects of changes of voltage or current on the power system. Ability to use algebra to compute total impedances, current flow, voltage, etc. of AC circuits with inductive and capacitive branches in order to determine whether bypass routings around outages will be able to carry the load.

Ability to interpret and apply oral and written operating instructions and electrical diagrams and drawings applying directly to the electric power distribution system. For example, ability to interpret operating instructions and distribution equipment operating criteria to determine when to adjust the taps on a transformer in order to maintain voltage on the feeder, when the probable alternative operating conditions and appropriate actions have been specified.

Responsibility: The Electric Power Controller, WG-8, receives detailed oral and written instructions from his supervisor, who is in charge of the shift. Decisions made are covered by specific, well-established work methods and procedures. In the event problems arise, the Electric Power Controller takes corrective action in accordance with his instructions or notifies his supervisor.

Physical Effort: Eye and hand coordination is required to operate switches and controls in accordance with meter indications. Experiences prolonged sitting as well as periods of walking, standing, and stooping.

Working Conditions: Primarily works inside in well-lighted, comfortable work spaces. Works outdoors for short periods. Occasionally works in proximity to high voltages and currents, subject to burns and shock.

Duties: The Electric Power Controller, WG-10 distributes and controls electrical energy through a primary electrical distribution system connecting numerous substations and switching stations, presenting many alternate routing possibilities. The power system serves a large activity or several closely related activities, such as military bases or other installations with similar self-contained distribution systems, which have many industrial or testing facilities whose operations cause wide fluctuations in load demand. The Electric Power Controller:

- Schedules power for various users in order to even out demand fluctuations and minimize peak power demands. Assigns blocks of power and may refuse to pick up low priority loads when operating at or near capacity.
- Controls and distributes electrical power through the primary distribution system. Operates the central switchboard to actuate remotely controlled circuit breakers, transformers, and switches in order to regulate and maintain proper voltage on the distribution lines, tie secondary circuits into the system, or prevent large loads from overloading the system by switching in parallel feeders or shifting the load to a higher capacity feeder.
- Closely monitors data from wattmeters, voltmeters and ammeters of various feeders. Observes operation of relays on feeders and remote operation of numerous substations. Is alert to detect indications of deteriorating conditions and to assure that equipment is operating within safe limits.
- When malfunction occurs, determines actions to take to isolate and bypass the fault in order to maintain service or takes actions to shed low priority loads when full service cannot be maintained. Instructs electrical linemen on location of failure, cause, and repairs needed. Assures that circuits are open and tagged before work is started.

In addition, may service and adjust converters, transformers, and switch gear. May check and adjust commutators and slip rings, replace brushes and switch contacts, and oil and clean rotating equipment. May replace parts, make minor repairs, and calibrate telemeters at outlying substations. Keeps hourly log of meter readings. Records shutdowns, connecting and disconnecting of circuits, and similar occurrences.

Skill and knowledge: Knowledge of a power distribution system characterized by a wide variety of users, including industrial operations which have large load changes, reactive loads requiring control of the power factor, and some peak loads which require setting up parallel networks. Ability to plan and control power distribution and to operate control board, and remote and manually controlled transformers, switches, and circuit breakers. Ability to analyze a variety of inter-related meter indications to detect abnormal conditions such as circuit overloads, improper line voltages, and equipment temperature. Ability to determine the causes and make necessary corrections by adjusting controls, such as balancing loads by adjusting phase relationships to improve power factor, changing transformer taps to regulate feeder voltage, switching to other equipment, or isolating the circuits affected, and dispatching repair crews.

Knowledge of electricity including voltage regulation, frequency control devices, theories of high-voltage transmission, and corona loss in order to operate equipment and determine and minimize circuit losses. Knowledge of trade mathematics to calculate amount of resistive and reactive loads, phase relationships of loads, etc., in order to identify unbalanced low efficiency loads, circulating currents, or other undesirable conditions. Knowledge of the effects of reactive loads and steps to take to compensate for them.

Ability to interpret priority lists to plan load shedding schedules. Ability to interpret load requests in order to schedule blocks of power requested by users, balance capacitance and reactive loads to achieve a good power factor, and make maximum use of purchased power. Ability to interpret operating instructions and distribution equipment operating criteria in order to determine the proper time to switch in other feeders, tie in parallel equipment, or adjust transformer taps to keep within specified operating range of voltage and current or set up the system to handle heavy loads.

Ability to interpret circuit diagrams and equipment layout drawings to determine which circuit breakers, transformers, etc., can be operated, and what rerouting can be done to provide power to undamaged portions of the system, and what circuits must be opened to allow repairs to be made safely.

Responsibility: Is assigned work orally and through written instructions and policies. Uses judgment in interpreting guidelines such as load shedding priority schedule, operating criteria of equipment, schematics, and wiring diagrams. Determines what problems to refer to supervisor; for example, refusing to pick up load request when the total load would be within the capacity of the system but anticipated weather conditions could put the system over the maximum. Reports to the supervisor all special occurrences such as emergency outages and corrective actions taken to maintain service. Is required to maintain continued alertness to anticipate unscheduled load changes and to detect early evidences of equipment malfunction in order to maintain continuous service.

Physical Effort: Eye and hand coordination is required to operate switches and controls in accordance with meter indications. Experiences prolonged sitting as well as periods of walking, standing, and stooping.

Working Conditions: Primarily works inside in well lighted, comfortable work spaces. Works outdoors for short periods. Occasionally works in proximity to high voltages and currents, subject to burns and shock.

JOB GRADING SYSTEM

WG-5407-10

Electric Power Controller, WG-10

WG-5407-10

Duties: The Electric Power Controller, WG-10 distributes and controls electrical energy through a primary electrical distribution system connecting a commercial power source, Government-operated power plant, and numerous substations and switching stations. The power system serves a large activity or several closely related activities, such as military bases or other installations with similar self-contained distribution systems, which have many industrial or testing facilities whose operations cause wide fluctuations in load demand. The Electric Power Controller:

- Operates AC and DC switchboards to control and distribute electrical power through the primary distribution system. Operates controls to actuate remotely controlled circuit breakers, transformers and switches in order to regulate and maintain proper voltage on the feeders, tie secondary circuits into the system, and prevent overloads on the feeders by isolating large loads on separate circuits. Connects, disconnects, parallels, or substitutes electrical units or conductors by remote control from the control switchboard.
- Closely monitors load indicator gages to detect large changes in load. Operates turboalternator or diesel generator controls, changing the governor setting, to adapt to these load changes and maintain the optimum demand on commercial sources. Keeps constantly aware of factors which will cause large changes in load such as abrupt changes in weather conditions or scheduled changes in industrial operations. Coordinates with Boiler Plant Operators to anticipate these changes and get boilers and turbines on or off the line. Controls the electrical generation. Starts, stops, parallels, and synchronizes turboalternators and rotary converters.
- Closely monitors data from wattmeters, voltmeters and ammeters of the feeders. Observes operation of feeder relays and substations. When indications of deterioration or malfunction are observed, determines actions to take to isolate and bypass the area in order to maintain service or takes actions to shed low priority loads when full service cannot be maintained. Instructs electrical linemen as to location and cause of failure and repairs needed. Assures that circuits are open and tagged out before work is started.

In addition, may operate auxiliary systems located in the power plant area such as emergency generators, air compressors, and water or

sewage pumps. May perform minor maintenance of control equipment such as cleaning and adjusting relays and controls. Records in operation logs all necessary data on electrical generation, turbine operation, electrical distribution, and similar functions.

Skill and Knowledge: Knowledge of a power distribution system characterized by a wide variety of users, including industrial operations which have large load changes, reactive loads requiring control of the power factor, and some peak loads which require setting up parallel networks. Ability to plan and control power distribution and to operate control boards, generators, and remote and manually controlled transformers, switches, and circuit breakers.

Ability to analyze a variety of interrelated meter indications to detect abnormal conditions such as circuit overloads, improper line voltages, or equipment temperature. Ability to determine the causes and make necessary corrections by adjusting controls, such as balancing loads by adjusting phase relationships to improve power factor, or changing transformer taps to regulate feeder voltage, switching to other equipment, or isolating the circuits affected and dispatching repair crews.

Knowledge of power plant operation and ability to manipulate controls in order to start and stop the generator, synchronize it with the system and pick up the load, paralleling it on the bus, or control generator output to clip the peak load drawn from commercial system and keep a close relationship between peak power drawn and normal commercial purchases.

Knowledge of electricity including voltage regulation, frequency control devices, theories of high voltage transmission, and corona loss.

Knowledge of electrical theory and trade mathematics to calculate amount of resistive and reactive loads, phase relationship of loads, etc., in order to identify unbalanced, low efficiency loads, circulating currents, or other undesirable conditions. Knowledge of the effects of reactive loads and steps to take to compensate for them.

Ability to interpret priority lists to plan load-shedding schedules. Ability to interpret load requests in order to schedule blocks of power requested by users, balance capacitance and reactive loads to achieve a good power factor, and make maximum use of purchased power, including what local generating capacity will be necessary to clip peak demands. Ability to interpret operating instructions and distri-

bution equipment operating criteria in order to determine the proper time to switch in other feeders, tie in parallel equipment or adjust transformer taps to keep within the specified operating range of voltage and current, or set up the system to handle heavy loads.

Ability to interpret circuit diagrams and equipment layout drawings to determine which circuit breakers, transformers, etc., can be operated, what rerouting can be done to provide power to undamaged portions of the system, and what circuits must be opened to allow repairs to be made safely.

Responsibility: Is assigned work orally and through written instructions and procedures. Uses judgment in interpreting guidelines such as operating criteria of equipment, schematics and wiring diagrams, and determining load priority of various industrial facilities in order to set the automatic load shedding equipment. Determines what problems to refer to supervisor. Reports to the supervisor all special occurrences such as emergency outages and corrective actions taken to maintain service. Is required to maintain continual alertness to anticipate unscheduled load changes and to detect early evidences of equipment malfunction in order to maintain continuous service.

Physical Effort: Eye and hand coordination is required to operate switches and controls in accordance with meter indications. Job requires prolonged sitting and standing.

Working Conditions: Primarily works inside in well-lighted, comfortable work spaces. Occasionally works in proximity to high voltages and currents, subject to burns and shock. Sometimes exposed to noise and vibration when working in the generator room.